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A REPORT ON THE NUTRITIONAL STATUS OF CENTRAL NEW YORK SCHOOL CHILDREN

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A Report on the Nutritional Status of Central New York State School Children

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THE nutrition of children and young people is of concern to all of us. It is only since the beginning of this century that scientific studies have indicated the importance of good nutrition in the younger years for the physical and mental health of the person as he grows older. At present, there are many groups concerned with nutrition programs for children. As a basis for program planning and action, it is necessary to find out how well fed children in the State are. In this bulletin, a report is presented of recent research studies made by Cornell University with several groups of New York State children ranging in age from four through fifteen years. In general, the findings are in agreement with the results of other investigations made in New York State and elsewhere in the United States.

Plan of Nutrition Study

THE study was conducted from the spring of 1947 through the spring of 1952 with children from four schools in the central and southern part of New York State. Two of the schools had students from predominantly urban homes in communities with populations of approximately 13,000 and 29,000; a third school was in an industrial area of approximately 5,000 population; the fourth school was in a principally rural area of less than 1,000 population. The total number of children studied was 467.

Age and Number of Children Participating in Study

	Age	*Number*
Girls and Boys	4 to 6 years	91
Girls and Boys	7 to 9 years	72
Girls and Boys	10 to 12 years	77
Girls	13 to 15 years	124
Boys	13 to 15 years	103

Three hundred and twenty of the children were studied in both the spring and the fall to see if their nutritional status changed with the season of the year, but no significant change was found for any one age group or for the groups as a whole.

Each child's nutritional status was studied from three angles:

1. Each child kept one seven-day food record from which we were able to calculate the nutrients in his diet.
2. Each child was examined by a physician for physical defects that might be associated with nutritional deficiencies.
3. A sample of blood from the fingertip of each child was analyzed for hemoglobin, carotene, and vitamins A and C.

   Hemoglobin is the red coloring matter of blood and is important for carrying oxygen from the lungs to the innermost tissues of the body, thus allowing them to maintain proper nourishment. Carotene is a yellow colored substance, the chief dietary sources of which are leafy green and yellow vegetables. Carotene is converted in the body to vitamin A. Vitamin A is a colorless substance, the chief dietary sources of which are butter, cream, egg yolk, and fish liver oils. This vitamin is necessary for growth and for healthy eyes and skin. Vitamin C, or as it is often called, ascorbic acid, is involved in maintaining proper gum and mouth conditions, in forming substances vital to the construction of teeth, bones, and soft tissues, and, it is thought, in resisting infections.

Results of Studies of Seven-day Diet Records

THE seven-day diet records which the children kept were evaluated in terms of calories, protein, calcium, iron, and several vitamins—vitamin A, thiamine, riboflavin, niacin, and ascorbic acid. The total intake for the seven days was divided by seven to arrive at an average daily intake. This average was the basis for all analyses of the data and was usually compared with the Recommended Dietary Allowances of the National Research Council for each of the age ranges of the children studied. The Council has established allowances of suggested amounts of nutrients which in the eyes of nutrition experts would be desirable for the children. While it is recognized that a child is not poorly nourished because he does not meet all of the Allowances, the Allowances represent a level of intake of nutrients at which we should all aim.

In terms of general intake of nutrients, the seven-day records showed that the children studied received sufficient amounts of most nutrients, except calcium and ascorbic acid. The intakes of these two nutrients were usually below the Allowance recommended by the National Research Council. The younger

children ate food that more fully met the Allowances than did the older children. Investigators in other regions of the country have also found this to be true.

There are probably a number of reasons why this is true. In this study the parents kept the food records of the children in the lower grades, and as a result they may have been more accurate or easier to interpret for calculation than the records kept by the older children. Another factor may be the wide differences in maturity or body size of the children in the adolescent group. It is conceivable that some of the children of this age group would not physically require as high an intake as the Allowances suggest, while others may require more. Investigation showed this not to be the cause in this study. On the other hand, it is at adolescence that rebellion against parental control may occur. The parents no longer have close supervision over the food intake of the youngster, with the result that faulty eating may be unheeded. The parents may be unable to correct the faults or to recognize them as faults.

Results of the study emphasized the low nutrient intake of the adolescent girl, 13 to 15 years old. Many of these girls ate diets low in protein, iron, thiamine, riboflavin, niacin, and ascorbic acid. This was also true of adolescent boys, but to a lesser extent. Approximately 60 per cent of the adolescent girls and 45 per cent of the adolescent boys failed to meet the Allowances set up for their age group by the National Research Council. This low intake of nutrients, whether due to faulty food habits, decreased parental supervision, food faddism, etc., is extremely unfortunate. A plentiful supply of nutrients is especially needed during adolescence when the body is undergoing changes that involve formation of new tissues and hormones. It is particularly important for adolescent girls to be well nourished because the stresses of child-bearing often follow closely upon the stresses of adolescence.

Since there was such strong evidence of the inadequate diets of the adolescent children, it was decided to do a special study on the importance of breakfast and between-meal foods to the nutrient intake of this group of adolescents. The seven-day food records of 81 of the girls and 61 of the boys from the seventh and eighth grades of two of the schools were used in this part of the study. For the purpose of grouping subjects, if a child had any food, even coffee plus cream or sugar, which contributed calories and was consumed before going to school or immediately after rising on non-school days, he was considered to have had breakfast. If the child missed one breakfast during the seven-day period, he was classified in the "missed" breakfast group. According to these criteria, 88 per cent of the boys and 86 per cent of the girls ate breakfast every morning. The breakfasts contributed an average of approximately one-fifth to the total daily nutrient intake and to the Recommended Daily Allowances for these children. The average breakfast of the boys contributed

more to their daily intake and to their ability to meet the Recommended Daily Allowances than did the breakfasts of the girls. In other words, the boys' breakfasts were more adequate for their needs than those of the girls.

Recent study seems to show that an individual is less apt to feel so-called "mid-morning" fatigue and be able to perform his work more efficiently when the breakfast contains one-fourth to one-third of the day's total calories; the type and amount of protein received is also important. While some 86 to 88 per cent of the group ate some sort of breakfast, 73 per cent of the boys and 84 per cent of the girls received less than one-fourth of the day's intake of calories in their breakfast. Seventy-one per cent of the boys and 81 per cent of the girls had protein intakes below this recommended one-fourth for breakfast. Ascorbic acid, riboflavin, and calcium were nutrients supplied most abundantly by the breakfasts of the New York children. When the group of children that always had breakfast was compared to the group that missed even one breakfast per week, regardless of the quality of these breakfasts, it was found that those who never missed breakfast more nearly met the Recommended Daily Allowances than those who missed breakfasts. The most important differences in nutrient intake between the two groups were in ascorbic acid, calories, calcium, and phosphorus. From these data, it would appear that other meals of the day do not compensate for the loss of these nutrients caused by missed breakfasts. In general, one would criticize the breakfasts of the teen-agers as being inadequate in nutrient content.

The diets of the children were examined to see what contribution any between-meal foods made to the over-all adequacy of the diet. Eighty-eight per cent of the boys and 86 per cent of the girls ate between meals. These snacks mainly contributed calories to the diet. It was interesting to note the low contribution to ascorbic acid intake; citrus foods are evidently not popular as a between-meal food. Usually snacks contributed less than 10 per cent to daily nutrient intake and to the Recommended Daily Allowances and were of little importance in assuring an adequate intake of nutrients.

It was also thought of interest to see the relative importance various foods may have in the diets of children. Accordingly, seven-day diet records kept by 259 school children, 114 boys and 145 girls, were studied to see what percentage bread, milk, citrus fruits, eggs, meat (including poultry and fish), Irish potatoes, and vegetables contributed to the nutrient intake. These seven foods accounted for approximately 84 per cent of the ascorbic acid intake of the children, from 65 to 75 per cent of the protein, calcium, phosphorus, iron, thiamine, riboflavin and niacin, and 50 to 55 per cent of the vitamin A and calories. Milk was the most important single food and contributed significant amounts of calcium (32 to 64 per cent of the total intake for the boys, 41 to 68 per cent for the girls), protein, phosphorus, vitamin A, and riboflavin. There was a

direct relationship between the contribution of milk to the dietary and the way in which a child met his National Research Council Allowances. Such a finding illustrates the nutritional importance of milk in the daily diet. Meat was the next most important food, contributing significant amounts of protein, iron, thiamine, and niacin to the diet. Bread also played an important role in the teen-agers' diets, contributing between 12 to 23 per cent of the protein, iron, thiamine, niacin, and calories. It was noticed that bread contributed an increasingly higher proportion of the daily nutrients as the diet became poorer. Whether this was related to family economic status is not known. These diets would undoubtedly have been much poorer without the present enrichment program for bread.

Results of Physical Examination

ALL the children were examined by a physician for physical defects which might be associated with nutritional deficiencies. Such an examination included the subject's weight and height, general appearance, and the condition of the eyes, skin, lips, gums, tongue, and mucous membranes of the mouth. It is not surprising that there was a general absence of significant numbers of these physical symptoms of poor nutrition in the New York State children. One would expect this to be true in a population as well-fed as ours. In an otherwise normal person, physical lesions should be one of the last symptoms of poor nutrition to appear and then only after long-time insufficiency of nutrients.

Results of Blood Tests

THERE exists, at least for some of the known nutritive essentials, a relation between dietary intake of the nutrient and its level in the blood. One may attempt to predict a person's nutritional status by determining the content of some of these nutrients in the blood. Samples of blood, taken by pricking the finger of each student, were analyzed for hemoglobin, ascorbic acid, vitamin A, and carotene. The results for each of the nutrients were as follows:

Hemoglobin

Many of the seventh and eighth grade girls from three of the four schools where studies were made had hemoglobin levels lower than one would desire for this age. The boys of comparable ages tended to have higher hemoglobin levels than did the girls. Approximately 50 per cent of the pre-adolescent children (under 13 years) also had low hemoglobin levels. Low dietary intakes of iron and protein may cause low levels of hemoglobin in the blood. The dietary studies, mentioned previously, indicated that the adolescent girls had low intakes of iron and protein.

Ascorbic acid

In three of the four schools, 15 to 54 per cent of the adolescent students had low levels of ascorbic acid in the blood. Usually more boys than girls were in this category. Since ascorbic acid was one of the nutrients most often low in the diet, this blood finding was not surprising.

Vitamin A

All of the schools had 21 per cent or more of the children in the fair to poor range in respect to vitamin A content of the blood. In one school, 31 per cent of the boys were in the poor range.

Carotene

All of the schools had 24 per cent or more of the children in the fair to poor range in respect to the carotene content of the blood. In three of the four schools, 65 to 80 per cent of the children were in this category.

Discussion of Findings and Recommendations for Improvement

THE general level of nutritional status of the school children in Central New York State is not one to cause alarm. There are, however, certain parts of the diet and of the eating habits that need to be improved.

Both the dietary records and the blood analyses revealed that deficiencies of ascorbic acid, protein, and iron existed for the adolescent girls and boys. In fact, a general finding for the population in the Northeastern Region is a low dietary intake of ascorbic acid.[1] This suggests a need for eating more foods such as citrus fruits, tomatoes, leafy green and yellow vegetables, and potatoes, which are good sources of this vitamin.

The need for more protein in the diet can be met by additional servings of milk, eggs, meat, fish, and poultry, which all contain proteins of high biological value (usually referred to as animal proteins). Cereal proteins such as those found in bread, breakfast foods, and the other grain products, along with legume proteins such as those in peas, beans, and nuts, may be used to supplement the animal protein. Recent research has indicated that inclusion of some animal protein with each meal ensures the most efficient use of the daily protein intake. Protein is essential for the formation and proper functions of all tissues, the hormones, and the blood. All of the enzymes, compounds by which the body carries on digestive and metabolic functions, are proteins.

Iron is supplied by certain organ meats such as liver, and by legumes, cereals, and certain vegetables. Only a small part of the dietary intake of iron is ab-

[1]Cooperative Nutritional Status Studies in the Northeastern Region. IV. Dietary Findings. Rhode Island Agricultural Experiment Station. University of Rhode Island, Kingston. Bulletin 319. Contribution 802. June, 1952.

sorbed; thus one needs to eat more than the body actually requires. Any time there is a loss of blood from the body, an extra intake of iron is required for its replacement.

Calcium was low in the diet, but there are no blood or physical tests to help confirm a lack of the mineral. It would probably be wise, however, to add extra calcium to the diet in the form of milk and green leafy vegetables. Bread is also an important dietary source of calcium. This mineral is part of the bones, teeth, and, to a lesser extent, the soft tissues.

Breakfast is a meal which could be improved in its total nutrient content. Many of the children we talked to made their own breakfasts because the parents were either still in bed or had already gone to work. Often the parents expected the child to eat the same food as the adult did, coffee and rolls. Research done at the University of Iowa and the University of Nebraska has shown that an adequate intake of calories and of protein at breakfast prevents midmorning fatigue which is often accompanied by a headache and muscular tremor.

While the human has remarkable abilities to adapt to many circumstances, one of which may be a poor or mediocre diet, without showing undue stress, the abundance of food in our country not only makes this unnecessary but makes it wasteful of potential abilities. Proper selection of foods can result in well-balanced diets of reasonable cost. Dietary emphasis on the protective foods such as milk and milk products which supply most of the nutrients for an adequate diet (except for vitamin C and iron), plus meat, vegetables (especially raw ones), fruits, and cereals will inevitably result in an adequate intake of nutrients which in turn may lead to better health for all.

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